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**June 2002** 

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## **South Asia Regional Overview**



South Asia is important to world energy markets because it contains 1.3 billion people -- more than one-fifth of the world's population -- and is experiencing rapid energy demand growth. South Asia also is a major, and growing, contributor to global emissions of carbon dioxide.

Note: All information contained in this report is the best available as of June 2002 and can change.

#### **GENERAL BACKGROUND**

The South Asian region (Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka) has a huge population (more than one-fifth of the world

total) which is growing rapidly. At the same time, and despite rapid economic growth during the 1990s, the region has among the lowest per capita incomes in the world. For 2002, Pakistan is expected to experience a growth rate in real Gross Domestic Product (GDP) of 4.8%, with India at 5.5%. India is by far the largest South Asian country, in terms of population, GDP, land area, energy consumption, energy production, and carbon emissions. After India, Pakistan and Bangladesh are the next largest South Asian countries in these categories.

Overall, South Asia is in a period of transition as it strives to implement effective economic, political, social, and legal structures to support sustained growth. The International Monetary Fund (IMF) and the World Bank have arranged several billion dollars worth of

assistance to the region, with the IMF prescribing such measures as cuts in subsidies (including energy subsidies), deregulation, anti-poverty efforts, and increased privatization.

#### ENERGY OVERVIEW

Economic and population growth in South Asia have resulted in rapid increases in energy consumption in recent years -- well above the rate seen in the OECD. The Energy Information Administration (EIA) estimates that South Asia's primary energy consumption (NOTE: EIA energy statistics include only "commercial" energy sources, but not animal waste, wood, or other biomass, which accounts for more than half of the South Asia region's total final energy consumption) increased nearly 58% between 1991 and 2000. In 2000, South Asia accounted for approximately 3.9% of world commercial energy consumption, up from 2.8% in 1991. Despite rapid growth in energy demand, however, South Asia continues to average amongst the lowest levels of *per capita* energy consumption in the world, but among the highest in terms of energy consumption *per unit of GDP*.

Not counting "non-commercial" sources of energy like animal waste, wood, and other biomass, South Asia's *commercial* energy mix in 2000 was 44% coal, 34% petroleum, 13% natural gas, 7% hydroelectricity, 1% nuclear and 0.1% "other." There are significant variations within the region. Bangladesh's energy mix, for instance, is dominated by natural gas (68% in 2000), while India relies heavily (53%) on coal. Sri Lanka is overwhelmingly dependent on petroleum (78% in 2000), while Pakistan relies on natural gas (45% in 2000), petroleum (41%), and hydroelectricity (12%), and the Maldives is 100% dependent on petroleum. The Himalayan countries of Nepal and Bhutan have high shares of hydroelectric power in their energy consumption mix. In recent years, natural gas has been growing in importance as a source of energy in South Asia, especially for use in power generation, fertilizer and petrochemical production. However, the problems encountered by some developers of proposed liquefied natural gas (LNG) projects, and continuing tensions with Pakistan, which effectively blocks potential natural gas pipeline routes from the Persian Gulf and Central Asia, may present obstacles to the future enlargement of natural gas as a share of India's fuel mix.

The major energy issues facing South Asian nations today are keeping up with rapidly rising energy demand and beginning to promote cross-border energy trade. Already, most of South Asia is grappling with energy shortfalls, usually in the form of frequent, costly, and widespread electricity outages. Given this situation, and in particular its potential economic and political ramifications, improving the supply of energy in general, and electricity in particular, is a major concern among regional governments. In order to accomplish this goal, South Asia thus is faced with the challenges of diversifying traditional energy supply sources (and expanding the use of indigenous energy resources), promoting additional foreign investment for energy infrastructure development, improving energy efficiency,

reforming and privatizing energy sectors, and expanding regional energy trade and investment.

#### **OIL**

South Asia contains reserves of only 5.2 billion barrels of oil, around 0.5% of the world total. In 2000, the region consumed around 2.5 million barrels per day (bbl/d) of oil, and produced 0.80 million bbl/d, making South Asia a net oil importer of around 1.7 million bbl/d. The vast majority (around 740,000 bbl/d) of South Asia's oil production comes from India, including its offshore Bombay High field (which accounts for about one-third of total Indian oil output). Most of the remainder (around 58,000 bbl/d) of South Asia's oil production comes mainly from Pakistan. Most South Asian crude oil imports come from the Middle East, and this is likely to remain the case for years to come. South Asia's oil imports are expected to grow sharply as production remains about flat while demand soars. Oil imports are projected to more than double by 2020.. The vast majority of this oil is expected to come from the Middle East (located close to South Asia, with more than two-thirds of world oil reserves), with only small volumes coming from other areas.

Growing demand for transportation fuels and increased industrial power demand have been major factors behind the growth in South Asian oil consumption in recent years. Between 1991 and 2000, South Asian oil consumption -- led by India -- grew by about 47%, and EIA's *International Energy Outlook 2002* projects India's oil consumption will grow another 25% by 2005, reaching 2.5 million bbl/d (up from 2.2 million bbl/d in 2000). Sri Lanka imports all of its crude oil, which is used largely for electricity generation and transportation, and has refining capacity of 50,000 bbl/d. In recent years, Sri Lanka has increased its oil imports in an effort to diversify away from overreliance on hydroelectricity, which varies depending upon rainfall amounts. Between 1991 and 2000, Sri Lankan oil consumption roughly doubled.

#### Refining

The construction of adequate refining capacity to keep up with growing oil demand is of great economic importance to South Asia. Each South Asian country is proceeding with refinery construction plans. The largest recent project, the Reliance Industries refinery at Jamnagar in India, began operation in late summer 1999, and has a capacity of 540,000 bbl/d. The 100,000 bbl/d "Pak-Arab" refinery in Pakistan came online in late 2000, helping alleviate the country's refined products dependence. Petronet India, a company created in early 1998 as part of an agreement among India's three government-owned refineries (IOC, Hindustan Petroleum, and Bharat Petroleum) is building product pipelines that will add about 500,000 bbl/d to current pipeline capacity of about 325,000 bbl/d (all operated by IOC). Completion of these projects will shift the main transportation mode for petroleum products from rail to pipeline.

#### **NATURAL GAS**

At the beginning of 2002, South Asia's proven natural gas reserves totalled around 58.6 trillion cubic feet (Tcf), or about 1% of the world total, with potentially larger resources suspected but unproven. The region consumed and produced around 1.99 Tcf of natural gas per year in 2000. Around 43% of this was accounted for by Pakistan, 40% by India, and the remaining 17% by Bangladesh. If long-term projections of rapidly increased gas demand for South Asia are correct, the region will require either significant increases in production, imports, or most likely both. Gas imports to the region would require construction of infrastructure -- either pipelines or liquefied natural gas (LNG) facilities. Without such infrastructure, natural gas supplies could be constrained, and increased reliance on other fuels could result. This appears more likely in light of the financial issues which have delayed the completion of the Dabhol LNG and power project in India, and renewed tensions between India and Pakistan, which effectively block potential pipeline routes from large natural gas reserves in the Persian Gulf and Central Asia to India.

Natural gas usage has increased rapidly in South Asia, growing about 72% between 1991 and 2000. Natural gas is seen in the region as playing an important part in supplying new power plants in the region, plus as a means of diversifying away from expensive oil imports. An obstacle to the expansion of natural gas usage in South Asia is the region's inadequate domestic gas infrastructure. Indian proposals to import, for instance, will require that supporting infrastructure be in place before such imports can proceed. Cross-border gas pipelines also would hinge upon the successful construction of domestic gas pipeline systems first.

Natural gas is Bangladesh's main source of commercial energy. Bangladesh currently has estimated proved natural gas reserves of around 16.3 trillion cubic feet (Tcf) in approximately 20 fields (mainly onshore), although gas reserves estimates vary widely, with foreign energy companies such as Shell and Unocal, for instance, believing that Bangladesh's gas reserves actually might be much higher than the official figure. The US Geological Survey recently estimated that Bangladesh contains an additional 32.1 Tcf in additional "undiscovered reserves." If the higher estimates prove to be correct, Bangladesh could at some point become a major gas producer (as well as supplier to the vast potential market in neighboring India). Gas exports are controversial within Bangladesh, however, with many people feeling that Bangladeshi gas resources first should be used for domestic purposes (i.e., electric power generation, fertilizer production, transportation), and also that the size of the country's gas reserves remains highly uncertain, particularly in relation to future domestic demand projections.

Indian consumption of natural gas has risen faster than any other fuel in recent years, and

now accounts for around 7% of the country's energy demand. From nearly 0.8 Tcf in 2000, Indian gas demand is projected in the *International Energy Outlook 2002* to reach 1.2 Tcf in 2005 and 1.6 Tcf in 2010, a significant reduction from previous forecasts, but still a large increase. Increased use of natural gas in power generation will account for most of the increase, as the Indian government is encouraging the construction of gas-fired electric power plants in coastal areas where they can be easily supplied with LNG by sea. While India's Foreign Investment Promotion Board (FIPB) has approved 12 prospective LNG import terminal projects, several have been delayed or cancelled outright between 2000 and 2002, and only the Dabhol project has had any construction activity, which is now halted due to financial disputes.

Pakistan has 25.1 Tcf of proven gas reserves, and currently produces nearly 0.86 Tcf of natural gas per year, all of which is consumed domestically. Pakistan plans to make gas the "fuel of choice" for future electric power generation projects. This will necessitate a sharp rise in production of natural gas.

Several import schemes also have been under discussion in recent years. In mid-2000, Pakistan's government stated that it would permit a gas pipeline linking Iran's massive gas reserves to rival India to cross its territory. Pakistan would earn transit fees for Iranian gas supplied to India and also be able to purchase gas from the pipeline itself. While Iran and Pakistan have shown great interest in the project, India has been reluctant to move forward as long as political and military tensions with Pakistan over Kashmir persist. Another possibility is that Pakistan could eventually be linked into the Dolphin Project, a scheme to supply gas from Qatar's North Dome gasfield to the United Arab Emirates and Oman, via a subsea pipeline from Oman. Even though Pakistan has signed a preliminary agreement to eventually purchase gas from Qatar, it seems increasingly unlikely that Pakistan will be included in the project in the near-term, due to it financial weakness and uncertainty about whether there will be sufficient demand growth. A third possible gas pipeline would link gasrich Turkmenistan with Dalautabad in central Pakistan via Afghanistan. Unocal had been the main foreign backer of the plan until August 1998, when it withdrew from the project after the U.S. strikes against terrorist training camps associated with Osama bin Laden in Afghanistan. None of these proposed projects, however, seems to have made any real progress over the last couple of years.

Bhutan, the Maldives, Nepal, and Sri Lanka do not currently produce or consume any natural gas.

#### **COAL**

South Asia contains 86 billion short tons of coal, or around 15% of the world total. Currently, coal accounts for 44% of South Asia's energy consumption. Nearly all of this is

produced and consumed by India, the only South Asian country with significant coal reserves, and the world's third largest coal producer (after the United States and China). Indian coal generally is of poor quality -- i.e., low in calorific content and high in ash -- and primarily is located far from major consuming centers. Power generation accounts for about 70% of India's total coal consumption, followed by steel and other industries. India's coal consumption is expected to increase to 546 million short tons (Mmst) by 2020, up 48% from 369 Mmst in 2000. Largely for this reason, South Asia's carbon emissions are expected to increase sharply in coming years.

Coal currently plays a relatively minor role in Pakistan's energy mix (5% in 2000), but the discovery of large volumes of low ash, low sulfur lignite in the Tharparkar (Thar) Desert in Sindh province will have a positive impact on consumption levels. Bangladesh and Sri Lanka have small coal reserves, and consume almost no coal, though Bangladesh has current plans to begin commercial coal production and build a coal-fired power plant with Chinese assistance.

#### **BIOMASS (NON-COMMERCIAL FUELS)**

As is the case in many developing countries and regions, South Asia continues to rely heavily on biomass (i.e., animal waste, wood, etc.) for its energy needs. As of 1995, for instance, biomass accounted for 56% of the region's final energy consumption, and 46% of its primary energy use (according to the International Energy Agency -- IEA). Also according to the IEA, around 20%-30% of South Asia's biomass use is animal waste, with another 20%-30% made up of agricultural residues, and only small amounts of charcoal. Biomass generally is burned directly using traditional, low-efficiency equipment. Biomass is consumed mainly in rural areas of South Asia. The IEA has projected South Asian biomass use to be approximately flat through 2020.

#### **ELECTRICITY**

In 2000, South Asia generated 633 billion kilowatt hours (Bkwh) of electricity. Of this, around 81% was from conventional thermal power plants, 17% from hydroelectric plants, and 2% from nuclear, and less than 1% for "other renewables" (like wind and solar). Also in 2000, India accounted for the vast majority (86%) of regional electricity generation, followed by Pakistan (10%), Bangladesh (2%), Sri Lanka (1%), Nepal, Bhutan, and the Maldives (1% total). Regional electricity generation is expected to increase significantly in coming years. While natural gas use had been expected to increase at the expense of coal's share, this is much less certain given the delays nad problems in supplies of imported natural gas to India. Nuclear and hydro are expected to increase their shares, with oil maintaining an approximately constant share. Non-hydroelectric "renewable" capacity (i.e., wind, solar, ocean, biomass, geothermal) is small at present, but is increasing, with wind power considered the most promising.

Electricity demand in South Asia is currently outstripping generating capacity, except in Pakistan, and the region as a whole is characterized by chronic electricity shortages. The main reasons for this situation are: shortfalls in building new power plants; low plant load factors due to aging generators and poor maintenance of equipment at existing plants (plus low-quality coal in many cases); and losses of power due to poor-quality transmission lines and theft. South Asia's rapidly rising electricity demand has heightened the need for additional investment by independent power producers (IPPs). However, bureaucratic obstacles and underdeveloped regulatory policies guiding such investment have led to construction delays as well as to foreign investor disillusionment, and most large IPP projects in the region have been delayed or cancelled over the past two years. Electricity rates are widely subsidized in South Asia, and state electricity companies are faced with the challenge of paying IPPs their asking price for power while simultaneously providing low rates for electricity to their customers, and losing a substantial percentage to theft. Meanwhile, the IMF and the World Bank have encouraged liberalization of South Asian power sectors, including reduction of subsidies. Meeting future electricity demand promises to pose a major challenge for South Asia.

India, which accounts for about four-fifths of South Asian electricity generation, is facing serious power supply problems (current generation is about 30% below demand, according to the Indian government). As a consequence, India is faced with the need to invest heavily in new electric generating capacity. Although about 80% of India's population has access to electricity, power outages and brownouts are common. India has forecast total additions of 111,500 MW will be needed by 2007, but it looks unlikely that this target will be met. Overall, Indian power demand is projected in the *International Energy Annual 2002* to increase to 923 billion kilowatthours (Bkwh) in 2020, about 81% above the 510 Bkwh consumed in 2000, but a substantial downward revision to the previous forecast. India generates around 83% of its electricity from conventional thermal power plants, around 14% from hydroelectric plants (located mainly in the north and northeast of the country), and the rest from nuclear plants.

As of 2000, Pakistan had 17 gigawatts (GW) of installed electric generating capacity. Thermal plants (oil, gas, and coal) make up about 71% of this capacity, with hydroelectricity making up 28% and nuclear plants 1%. Pakistan's total power generating capacity has increased rapidly in recent years, due largely to foreign investment in the mid-1990s, which has now decreased due to payment problems at those projects. Rotating blackouts ("load shedding") are, however, necessary at times in some areas. Transmission losses are about 30%, due to poor quality infrastructure and a significant amount of power theft. Seasonal reductions affect the availability of hydropower. With much of the Pakistan's rural areas yet to receive electric power, and less than half of the population connected to the national grid,

significant demand growth is expected in the long term, though in the short term, Pakistan has some excess generation capacity.

In Bangladesh, only around 18% of the population (25% in urban areas and 10% in rural areas) has access to electricity, and per capita commercial energy consumption is among the lowest in the world. With power demand growing rapidly (a 60% increase from 1991 to 2000), Bangladesh's Power System Master Plan (PSMP) foresees a doubling of required electric generating capacity by 2005 at a cost of \$4.4 billion. On top of this, Bangladesh likely will need to replace 30%-40% of existing generating capacity. Power shortages can have serious social consequences, as demonstrated on April 10, 1999, when violent clashes took place in Dhaka between police and people protesting inadequate power supplies and demanding better service. Bangladesh generates its electricity mainly at thermanl power plants (93%), but also has some hydroelectric dams (7%). Discussions have been underway among Southern Asian nations for development of a regional electricity grid. Such a grid could lead to increased efficiencies and reduced power generation and transmission costs. Nepal and Bhutan have substantial untapped hydroelectricity potential. This power could be consumed in those two countries and also exported to India, Pakistan, and Bangladesh. In March 1999, it was reported that India's Power Grid Corporation had completed a feasibility study on possible exchange of 150 MW of power between Bangladesh and India. Interconnection points would be Ishwardi, Bangladesh-Farakka, India and Shahjibazar, Bangladesh-Kurnarghat, India.

Sri Lanka is almost totally reliant on hydropower for its electricity, making it vulnerable to fluctuations in rainfall. The Sri Lankan government is trying to attract foreign investors to build independent thermal power plants, but has yet to clarify its regulatory policies. Net electricity consumption in Sri Lanka doubled between 1991 and 2000.

Like Sri Lanka, Nepal relies almost exclusively on hydroelectricity for its power needs. Nepal also has large untapped hydroelectric potential, which could be developed both for domestic consumption (only about 15% of Nepal's population currently has access to electricity) as well as for export (the main potential export market being India). Renewable power sources, including micro-hydro, and solar energy, is gaining popularity in Nepal, particularly in remote regions of the country. In recent news, the 144 MW Kaligandaki "A" hydroelectric dam began generating electricity in March 2002. Australia's SMEC International signed a contract in January 2002 for the development of the West Seti hrdroelectric dam, which will take five years to develop and have an installed capacity of 750 MW. Most of the power from the West Seti project will be exported to India.

Bhutan also has the potential to become a major hydropower exporter. Some estimates have put the country's potential hydropower resources as high as 30 GW. The main large project

currently under development is the Tala hydropower project, which is to be operational by 2004-2005. It will have an installed capacity of 1,020 MW, and produce power for export to northern India.

Table 1. Economic and Demographic Indicators for South Asian Countries

	Gross Domestic Product (GDP)					
	2000E (Billions of	Real GDI	P Growth Rate	Per Capita GDP, 2000E	Population,	
	US\$ PPP*)	2001 Estimate	2002 Projection	(US\$ PPP)	2000E (Millions)	
Bangladesh	\$203	N.A	N.A.	\$1,570	131	
Bhutan	\$2.3	N.A.	N.A	\$1,100	2	
India	\$2,200	5.5%	5.9%	\$2,200	1,029	
Maldives	\$0.6	N.A.	N.A.	\$2,000	0.3	
Nepal	\$33.7	N.A.	N.A.	\$1,360	25.3	
Pakistan	\$282	3.4%	4.8%	\$2,000	145	
Sri Lanka	\$62.7	N.A	N.A.	\$3,270	19.4	

Sources: CIA World Factbook; WEFA; Economist Intelligence Unit. \*PPP = Purchasing Power Parity exchange rates

**Table 2.** Energy Consumption and Carbon Dioxide Emissions in South Asian Countries, 2000

								Carbon Dioxide	
	Commercial Energy Consumption <sup>1</sup>								
								(Million	
	Total							metric	
	(Quadrillion		Natural					tons of	
	Btu)	Petroleum	Gas	Coal	Nuclear	Hydroelectric	Other <sup>2</sup>	carbon)	
			10.1	4					
Bangladesh	0.50	30%	68%	1%	0%	1%	0%	7.7	
	0.04		0.04	240/					
Bhutan	0.01	24%	0%	21%	0%	55%	0%	0.1	
T 11	10.5	2204	<b>7</b> 0/	<b>70</b> 0/	10/		0.204	2522	
India	12.67	32%	7%	53%	1%	6%	0.2%	253.3	
N	0.004	1000/	00/	00/	00/	00/	00/	0.1	
Maldives	0.004	100%	0%	0%	0%	0%	0%	0.1	
NT 1	0.06	<i>570</i> /	00/	1.40/	00/	240/	<b>5</b> 0/	0.0	
Nepal	0.06	57%	0%	14%	0%	24%	5%	0.8	
D-1-1-4	1.01	410/	420/	<b>5</b> 0/	00/	120/	00/	20.5	
Pakistan	1.91	41%	42%	5%	0%	12%	0%	29.5	
C.: I1	0.10	700/	00/	00/	00/	220/	00/	2.6	
Sri Lanka	0.18	78%	0%	0%	0%	22%	0%	2.6	
T ( 1	15.00	240/	120/	4.40/	10/	70/	0.20/	204.1	
Total	15.28	34%	13%	44%	1%	7%	0.2%	294.1	

<sup>&</sup>lt;sup>1</sup>Note: Does NOT include such "non-commercial" energy sources as animal waste, wood, and other biomass, which account for more than half of South Asia's total final energy consumption.

Note: Percentages may not add to 100% because of independent rounding.

<sup>&</sup>lt;sup>2</sup>Other includes consumption of wind electric power for India and net imports of electricity for India and Nepal. Other does NOT include biomass or other "noncommercial" sources of energy.

<sup>&</sup>lt;sup>3</sup> Includes carbon dioxide emissions from the consumption of petroleum, natural gas, and coal, and from the flaring of natural gas. Tons of carbon can be converted to tons of carbon dioxide gas by multiplying by 3.667.

Source: Energy Information Administration, International Energy Database, May 2002.

**Table 3.** Energy Supply Indicators-- South Asian Countries

	Fossil Fuel Proved Reserves			Fossil Fuel Production				
	Crude Oil, 1/1/02 (Million barrels)	Dry Natural Gas, 1/1/02 (Trillion cubic feet)	Coal, 12/31/98 (Billion short tons)	Petroleum, 2001 <sup>1</sup> (Thousand barrels per day)	2000	Coal, 2000 (Million short tons)	Electric Generating Capacity, 1/1/00 (Million kilowatts)	Crude Oil Refining Capacity, 1/1/02 (Thousand barrels per day)
Bangladesh	57	10.6	0	4	0.34	0.06	3.6	33
Bhutan	0	0	0	0	0	0	0.36	0
India	4,840	22.9	93.0	736	0.79	345.0	108.1	2,134
Maldives	0	0	0	0	0	0	0.03	0
Nepal	0	0	0.002	0	0	0.01	0.39	0
Pakistan	298	25.1	2.5	57	0.86	3.8	17.1	239
Sri Lanka	0	0	0	0	0	0	1.61	50
Total	4,195	58.6	95.5	797	1.99	348.9	131.2	2,456

<sup>&</sup>lt;sup>1</sup> Includes crude oil, natural gas plant liquids, other liquids, and refinery processing gain. Sources: Crude Oil and Natural Gas Reserves: PennWell Publishing Co., *Oil & Gas Journal*, 12/28/01. Crude Oil Refining Capacity: PennWell Publishing Co., *Oil & Gas Journal*, 12/28/01. All Other Data: Energy Information Administration, International Energy Database, May 2002.

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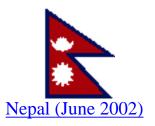
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